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SOME UNIQUE EXAMPLES OF DISPERSION OF SEEDS AND FRUITS.¹

PROF. W. J. BEAL.

IN the driftwood stranded here and there along streams may often be found dry, three-celled fruits of the bladdernut an inch and a half in diameter, brown and light, tough and water-tight. The seeds are very hard and smooth, enabling them, if kept in the water, to remain uninjured for a long time. But the ability to float on the water is not its only means of dispersion. Many of the dry pods hang on until winter, rattling in the wind. On falling, a portion remain near the parent bush and are liable to be carried away the next time the creek overflows its banks; others are moved by the wind, and perhaps again by the water, and still others may be drifted for long distances, even on an up grade, if there chances to be snow on the ground.

Here, among the rubbish in spring, are some shriveled wild grapes, which missed a golden opportunity of being eaten by certain birds which could not digest their bony seeds; but they have in reserve another mode of transportation, not by wing of bird, but by floating on water. Clean grape seeds will sink at once, but when covered by the dry skin and pulp they float. In a similar manner the dry seeds of several dogwoods are often eaten by birds for the pulps, but if not eaten they behave after the manner of grapes with dry, wrinkled skins.

Narrow-leaved dock is a prominent weed, and is especially at home along ditches and river bottoms. On the back of each dry persistent sepal is an ovoid, pithy or spongy tubercle, all of which are not exactly life-preservers, but they are the next thing to it. The naked achene sinks at once when free from everything else, but when encased in its dry calyx it floats on the water.

¹ Read before Section G, American Association for the Advancement of Science, Boston Meeting, August, 1898.

In wet places sedges abound. Those of the genus *Carex* have each fruit enclosed by a sack (perigynium). In most sedges growing in wet land the sack is considerably larger than the enclosed achene and serves to float the denser portion. Without the perigynium the ripened achene sinks at once.

Some of the lowland sedges, like *Carex stipata* and *C. sterile*, have a perigynium only slightly inflated, but to buoy up the achene well there are small masses of corky substance inside.

Species of *Carex* which grow on dry land, like *C. pennsylvanica* and the rest of the tribe, have the sack fitting closely instead of inflated, and the whole mass sinks readily in the water.

In the drifted material under consideration are achenes of arrowhead, *Sagittaria*. They are flattened, and on one edge or both, and at the apex is a spongy ridge that serves the purpose of a raft to float the small seed within, which would sink readily if separated from the light substance that grew on its sides. In this connection may be studied achenes of *Alisma*, bur reed, cat-tail flag, arrow grass, burgrass, numerous potamogetons, several buttercups, the hop, nettles, false nettle, cinquefoil, avens, and others.

There grows along streams a common grass known as *Elymus virginicus*. A pair of corky, empty glumes adhere to one or more of the mature florets between them and serve as boats to carry the ripened grain to a new spot.

The compressed grain of rice-cut grass (*Homalocenchrus oryzoides*) is enclosed by a pair of glumes, and they float well on the water, but if the glumes are removed the grain drops to the bottom immediately.

Noticeable among seeds in the floodwood are some of the milkweeds, which every one would say at a glance were especially fitted for sailing through the air, aided by numerous long, silky hairs. These hairs are no hindrance to moving by water. The flat seed has a hem-like margin, which must aid the wind in blowing it about, but this margin is thickened somewhat by a spongy material. With the margin attached, it floats; without it, the seed sinks in fresh water.

The bulblets of wild garlic are numerous on the river flats, and they float readily whether dry or growing.

The Kentucky coffee-bean tree is not abundant in southern Michigan, but is oftener found along streams than elsewhere. The large pulpy pods may have induced buffalo, elk, or mastodon or other animals to eat, and thus distribute the very hard seeds, but in these times the pods usually remain on the tree till well dried, even till late in winter. When they dry they will float, carrying the seeds with them, but the seeds by themselves sink at once.

In winter we often see dead tops of lamb's-quarter and the smooth and the prickly pigweeds still standing where they grew in the summer. These are favorite feeding grounds for several kinds of small birds, especially when snow covers the ground, and at such times some of the achenes enclosed in the thin, dry calyx drop to the snow and are scattered by the wind. Birds carry away some of them, the wind blows some over the snow, and still others float on the water, buoyed by the persistent calyx. Without the calyx the achene sinks to the bottom of pond or stream.

The common locust tree blossoms, and large numbers of thin, flat pods are produced; but even when the seeds are ripe, the pods remain of a dull color. The pods of the locust wait and wait, holding fast for a long time, but nothing comes to eat them. They become dry and slowly split apart, each half of the pod usually carrying every alternate seed. Some of the pods with the seeds are torn off by the wind, and fall to the ground sooner or later, depending on the force of the wind. Each half pod as it comes off is slightly bent and twisted, and these are want advertisements given to the wind: "Here I am, thin, dry, light and elastic, twisted and bent already; give me a lift to bear these precious seeds up the hill into the valley or over the plain."

And the wind is sure to come along, a slight breeze to-day tossing the half pod a few feet, leaving it perhaps to be again and again moved further forward. I have seen them transported by this means to the distance of more than sixty yards. But many of the pods stick to the limbs till winter comes. A

breeze tears off a few pods, and they fall on the snow, which has filled up all the crevices in the grass and between the dead leaves and rubbish. Each half pod freighted with seed is admirably constructed, like an ice boat, with sail always to the breeze. In this way there is often nothing to hinder some of the seeds from going a mile or two in a few minutes, now and then striking some object which jars off a seed or two. The seeds are very hard, and no doubt purposely so, that they may be seldom eaten by insects or birds; but once in moist soil, the covering slowly swells and decays, allowing the young plant to escape. Thus the locust seeds are provided with neither legs, wings, fins, nor do they advertise by brilliant hue and sweet pulp, but they travel in a way of their own, and literally on the wings of the wind.

On lowlands, more or less abundant throughout the Northern Temperate Zone, is found the great willow-herb, *Epilobium angustifolium*. When ripe the slender pod slowly recurves from the top into four pieces and exposes the very small seeds, each having at one end a tuft of fine, white, silky hairs nearly half an inch long. Almost every one would think the seeds grew in this manner to be scattered by the wind, and no doubt this is correct. I call your attention to the plant for the purpose of showing that the tips of the hairs stick slightly to grooves inside of the recurved valves, some hairs to one valve, and often others to the adjacent valve, thus spreading them apart with the seed suspended between. Four rows of the seeds are thus held out at one time. Not over half to a tenth part of the seeds are well developed, yet the silky hairs are present and float away in clusters, helping to buoy those that are heavy. This is a capital device, and when dry and unfurled, it silently indicates to the slightest breath of air that the seeds are ready for a flight, and it does not take much to carry them a long distance.

Do you know why so many kinds of plants produce very small and light seeds? Would it not be better if they produced fewer and larger seeds which would be stronger and better able to grow under adverse conditions? But many small seeds cost the plant no more effort than a small number of large ones.

The lighter and smaller the seeds, and the more there are of them, the better their chances for distribution, especially for long distances. The minute size of spores of most of the fungi are given as a reason why so many of them are so widely distributed. Why is a boy or man of light weight secured to ride the horse on the race track? That the animal may have less weight to carry, and thereby use his surplus strength in making better time. The less weight the parachute of the seed of the willow-herb has to carry, the greater the chances for success in making a long journey. Of the willow-herb, it takes one hundred seeds to weigh a milligram, including the hairs attached to them, and it would take thirty thousand to weigh as much as an ordinary white bean.

Ripened pods of *Lilium superbum* usually stand straight up on a stiff elastic stem; beginning at the top, each one slowly splits, and the three parts separate from each other. Why do they not burst open all of a sudden, like pea pods, and shoot the seeds all about, and have the job done with? Or why does not the pod burst open at the lower end first instead of the upper? Observe that the coverings of the cavities are lashed together loosely with a latticework. No slight breeze can dislodge the seeds, but just see how they behave in a gale! The elastic stems are swayed back and forth against each other, and some of the upper seeds are tossed out by the wind which passes through the lattice, and at such times are carried forward. The seeds at the top having escaped, the dry pods split down farther and still farther, and open still wider, till the bottom is reached. Succeeding breezes may come from different directions, and, as the seeds are not all carried away the first, or even the second time, there are some left to be scattered about.

The seeds of the lily are flat and rather light, not to be shot out like bullets, but to be carried a little way by the wind; the pods are erect and open at the top, that they need not escape when there is no wind unless some animal gives the stem a strong shake. I mention this plant on purpose to call your attention to the admirable scheme for economizing the supply of seeds. The latticework was made for a purpose, and the

gradual opening of the pods prevents the supply from all going at one time in one direction or in one day, when a better day may arrive.

We shall find nearly or all flattened seeds or fruits are one-sided, unbalanced, and more or less twisted, so in falling to the ground they whirl about and are thus kept much longer in the air than they would be if shaped more like a winged arrow. Even the wings on the fruit of some of the ashes are twisted, though many of them are flat.

There are a number of rather weedy-looking herbs, common to woods or lowland, known as avens (*Geum*). They are closely allied to cinquefoil, and all belong to the rose family. The slender styles above the seed-like ovaries of some species of avens are described not as jointed, but straight and feathery, well adapted, as we might suppose, to be scattered by the wind, while others are spoken of as having, when young, styles jointed and bent near the middle. In maturing, the lower part of the style becomes much longer and stouter. When a whole head of pistils has drawn all the nourishment possible, and all that is needed from the mother plant, the upper part of each style drops off, leaving a sharp, stiff hook at the end. At that time each pistil loosens from the head and can be easily removed, especially if some animal touches the hooks. To help in holding fast, there are a number of slender hairs farther down the style which are liable to become more or less entangled in hairs, fur, wool, or feathers. Even in the small number of plants here noticed, we have seen that scarcely any two of them agree in the details of their devices for securing transportation of seeds. I know of nothing like the *Geum* we are now considering. When young and green, the tip of each hook is securely protected by a knob or bunch with a little arm extending above, which effectually prevents the hook from catching on to anything, but when the fruit is ripe, the projecting knob with its little attachment disappears.

Nycandra physaloides, or Apple of Peru, a coarse annual sometimes cultivated, is spoken of by Gray as bearing dry berries. Each suspended berry is covered by a five-parted inflated calyx. The edges of the sepals come together and

project outward, making a secure covering for the fruit. In time the berry and the papery calyx ripen, and the pedicel becomes stiff and elastic. In five places close up under the calyx the "skin" of the fruit splits open and rolls slowly back, exposing seeds. The dry dehiscent pods of most kinds of plants become wet, close up more or less, and suspend the scattering of seeds in time of a shower. Not so with *Nycandra*, for each berry is kept dry by an umbrella, cap, or shed, which nature has deftly built. The numerous persistent, inflated calyxes expose much surface to the wind, even after the leaves have left the dry plant. The dead plant is rattled about by every breeze, scattering seeds freely. While these are dropping, the five scrolls on the surface continue to open further and further, permitting more seeds to fall.

Some friends of mine collected a quantity of hazel nuts and placed them near the house, while yet the green husks enclosed the nuts. At once they were discovered by a blue jay, which picked out a nut at a time, flew away, held the nut between its toes, cracked it from the apex, and ate the contents. In this operation a number of nuts slipped away and were lost. Half a dozen or more grew, and to-day a new patch of hazel bushes is growing in the yard.

The unicorn plant (*Martynia proboscidea*) is a coarse diffuse herb found growing from southern Indiana to Iowa and northern Mexico. The ripened fruit is oblong, about three inches long and an inch in diameter, with a beak at the base, and two long, slender, spreading and incurved points at the apex. On the side of the fruit next to the long curved beaks is a crest, consisting of stiff pieces a fourth of an inch long. The whole is tough, hard, and elastic. The three beaks curve toward each other, roughly outlining two-thirds of a circle with a diameter of five inches. It is a queer-looking thing, difficult to describe. A peck of them placed in a basket hold together well, having developed the propensity "to catch on" to a remarkable degree. The three beaks curving toward each other, with the crest inside the ring, adapt it admirably to become attached to the feet of cattle, sheep, horses, and the buffalo, which once roamed over this region in great abundance.

Since reading the above concerning Martynia, J. B. S. Norton, of the Botanical Garden, St. Louis, informed me that he had often seen the points hanging on the feet of cattle or horses on the prairies of Kansas, where the plant in many places has become a bad weed. In some instances several points were seen attached to one foot.

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